Консорциум экономических исследований и образования - Россия и СНГ
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Marina Malyutina, Svetlana Parilova [1]

The Determinants of Excessive Risk-Taking by Banks in Transition

Final report

1 INTRODUCTION

More than 1200 banks have lost banking license since first commercial banks appeared in Russia in late 1980-ies (that is about half of all ever registered banks). August 1998 was disastrous for Russian banking sector. The banks still did not recover from the consequences of the crisis: value of assets of the banking industry as well as total bank capital in the country is still by far less than prior August 1998. Such crisis is not peculiar for Russia. Banking crises appeared here and there in developing as well as developed countries; they often are considered as an inevitable consequence of financial liberalization.

Although systemic banking crises are usually triggered by a macroeconomic shock, effectively they reveal problems accumulated by the banking industry. Therefore the roots of banking crises should be found at a micro-level. The ultimate cause of a bank's failure is usually bad asset decisions, resulting in bad loans and other losses. In our view, problems of many Russian banks were caused by excessive risk-taking of the banks themselves and not by devaluation or default on the government debt. Poor environment the banks were operating in, including regulator being interested in the outcome of risky project, created incentives for risky behavior. The main factors explaining excessive risk-taking of Russian banks are bad

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supervision, non-transparent financial reporting, high discount factor for future cash flows, and lack of safe investment opportunities.

We develop a game of incomplete information of two players - a bank and a regulator - that reflects key features of banking in transition: weak supervision and existence of a scope for manipulating accounting figures. Subgame perfect Bayesian Nash equilibrium of the game outlines optimal behavior of banks and a regulator in transition. Predictions of the theoretical model bring us to the set of testable hypothesis, which are tested on the extensive data set including quarterly data for a vast majority of Russian banks for 1998-1999.

The paper is structured as follows: the next section is devoted to literature review. In the third section we develop theoretical model: starting from a case of one-period game we then we proceed to infinitely repeating game. The forth section deals with the empirical testing of the hypothesis rendered by the theoretical model. The fifth section concludes.

2 LITERATURE REVIEW

Phenomena of bank failures received due attention from researches and policymakers and causes of banking crises were extensively studied. The bulk of literature can be broadly divided into those finding macro-level reasons to be the main determinants of bank failures and those that attribute the main role to microeconomic ones. Paradoxically at the first glance, financial stabilization was often named as one of the causes of banking crises (Demirguc-Kunt, Detragache, 1997, 1999). Looking closely, however, one would see that the primary item of banks' profits in financially unstable environment was inflation-based revenues and by no means traditional banking. In the course of financial stabilization banks were deprived of such revenues and their financial state started to deteriorate. Further macroeconomic shock in the form of devaluation or default leads to forex losses, sharp rise in unpaid loans and consequent crash of banking system. Thus, often banking crisis is viewed as a twin of a currency crisis (Kaminsky, 1998). However, some authors argue that macroeconomic shocks taken alone cannot be blamed for the banking crises as they only reveal the problems accumulated by the banking industry. In this respect micro-based factors are of the same or even greater importance as macro ones in explaining bank's failure and excessive risk taking.

A common feature of banking industries in transition is large number of banks compared to developed countries. Sometimes it is argued that such overpopulation undermines stability of banking system. Schnitzer (1998) suggested a model showing that the accumulation of bad loans is more likely the greater the number of banks is.

In most countries capital requirements are used to limit speculative activities of the banks. A bank that chooses more risky strategy should have larger capital. This makes banks owners/managers more careful and therefore helps to defend bank's creditors. Much research on bank risks considers relations between bank's risk taking and its capital. The problem can be studied in static (Furlong and Keeley, 1989) or dynamic (Milne and Whalley, 1998) environment, on micro- or macro- level (Gorton, Winton, 1995). A detailed survey of recent studies is provided in Freixas and Rochet (1998).

Prudential regulation is another issue extensively studied in the literature. Efficiency of the regulation determines the possibility of banks to expose themselves to excessive risks. As it is shown in Mailath and Mester (1994) position of a regulator seriously affects behavior of a bank. Interestingly, in the latter paper bank's choice between risky and safe strategies is analyzed without any initial capital requirements. This goes in line with recent discussion whether capital requirements taken alone can be sufficient to regulate banks' riskiness. The question is vital for countries in transition with typically weak prudential supervision (see Hellmann, Murdock, Stiglitz (1999) or Caprio and Honohan (1998)). A survey of studies on the issues of prudential supervision and banking regulation is presented in Bhattacharya, Boot and Thakor (1998) or Dewatripont and Tirole (1994).

Banks as creditors can substantially influence the restructuring process. Therefore behavior of banks in transition environment received due attention. A situation when a bank provides inefficient loan was suggested in Dewatripont and Maskin (1995). They showed that a loan to inefficient borrower is a rational choice for a bank if this borrower already has a debt to this bank (related to sunk cost theory). Berglof and Roland (1995), (1997) developed this issue further. They modeled phenomena of soft budget constraint, when refunding of old borrower is efficient ex-post and inefficient ex-ante. An alternative explanation was suggested by Mitchell (1997), Mitchell (1998), where the soft budget constraint arises due to inefficient supervision and creditor passivity when banks have no incentives to show real amount of their bad debts (ex-ante and ex-post inefficiency). The survey of related models can be found in Mitchell (1999), Berglof and Roland (1998), Roland (1999).

A key idea for understanding some processes that had place in Russian banks over the crisis can be found in Akerlof and Romer (1993). Managers in Akerlof and Romer's framework do not gamble for resurrection. Their rationale to take more risks is not the hope to save their bank in the case of success, but instead the owners can simply take assets away from the firm, and thus pre-determine its inevitable bankruptcy. This model might be seen as a special case of above mentioned models of loan granting in transition as in Berglof and Roland (1998) or of general model of bank's behavior as in Mailath and Mester (1994). Here stolen assets could be considered as a private benefit of the manager and the probability of repayment as zero. In our view model of Akerlof and Romer is very relevant to transition economies, where financial intermediaries operate in the lax environment.

There are few works on the determinants of Russian banking crises. Perotti and Scard (1999) and Perotti (2000) state that the main reason of the Russian crisis of 1998 was imprudent bank's behavior in poor economic environment (poor creditor rights protection, poor law enforcement, and absence of real prudential regulation). The history of Russian banking system is presented in Матовников (1998). The causes of the banking crises are studied in Энтов (1999), Центр Развития (1999a, 1999b) and other publications. In most of these papers the research is concentrated on the aggregate indicators, and a banking system is viewed on the macro-level. At the same time a detailed microanalysis is practically absent. In this paper we look at the incentives of individual banks and banks behavior.

Mailath and Mester (1991) studied the interaction between bank and a regulator in the game theory framework. Bank’s current choice of assets affects the regulator’s policy regarding closure and bank understands it. Thus, the regulator’s policy in turn affects risk-taking of a bank. Studying subgame perfect equilibrium, Mailath and Mester came to a striking result that a credible regulator’s policy upon closure couldn’t be based on a simple cut-off rule on bank asset value. Depending on the set of parameters all 4 types of regulator strategies can be credible: forbearance, pre-emptive, incentive, and closure. Thus, the primary interest of Mailath and Mester (1991) model are the incentives of a regulator to close depository institution.

In Mailath and Mester (1991) behavior of a bank in the second period depends on the choice of nature regarding the profitability of risky asset in the first period. This result seems to be very important because it is consistent with our vision of the actual development of the process of problem accumulation in Russian banks expressed in the introduction. Therefore the incentives of bank’s risk-taking demand more detailed investigation than in Mailath and Mester model.

3 THE MODEL

The model presented below can be considered an extension of framework of Mailath and Mester (1991). We develop a game between a regulator and a bank with an element of uncertainty when the nature determines the outcome of a risky project. Therefore as Mailath and Mester suggested, bank behavior affects the strategy of a regulator, while the regulator's actions (or awareness about his strategy) in turn can influence bank's choice of moves.

However, the assumption of perfect information present in Mailath and Mester (1991) seems to be not plausible for the transition environment. We think that it is hardly the case in developed countries and definitely contradicts the characteristics of Russian environment. We view inefficient monitoring (possibly accompanied by corruption) as one of the conditions for creating moral hazard in banks resulting in excessive risk-taking. Therefore extent the model allowing for *incomplete information*. This would make regulator's claim to close a bank even less credible as we suppose was indeed the case in Russia.

3.1 Model assumptions

There are two players in the model: a bank and a regulator. At the beginning of the period the bank collects one unit of deposits and makes its investment decision. There are two investment opportunities available for a bank – safe and risky – which differ by rate of return and probability of being repaid. Safe asset has a gross return of $R_S = (1+r_s)$ at the end of the period; risky asset brings the gross return of $R_R = (1+r_r)$ with probability p and 0 otherwise. The interest rate on deposits is normalized to zero and deposits are due at the end of the period.

The return and the probability of success are subject to the following constraints:

$$pR_R - 1 < R_S - 1 \tag{1.1}$$

$$p(R_R - 1) = pr_r > r_s = R_S - 1 \tag{1.2}$$

This set of conditions is referred to in the literature as a moral hazard problem for a financial intermediary with limited liability (John et al, 1991). The first inequality signals that society prefers safe asset to a risky one as the expected return is greater than that for safe project. Looking at the second inequality one may see that a bank prefers risky investment opportunity due to a limited liability (note that it implies that $R_R > R_S$).

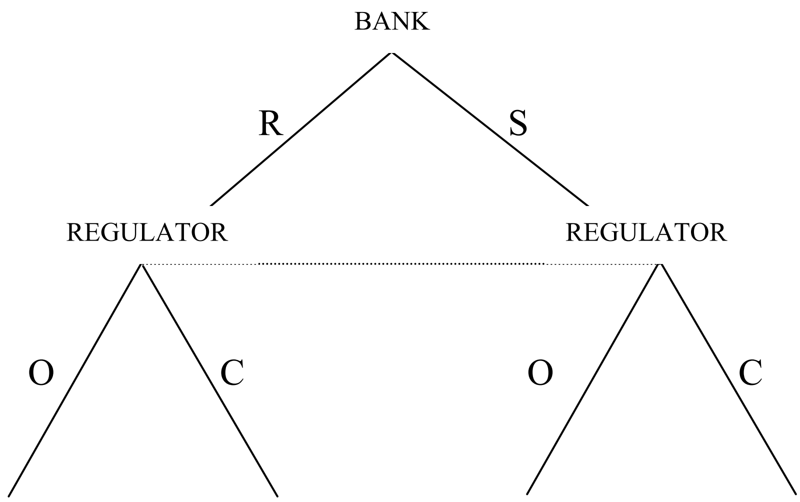
Regulator is the second mover. The objective of the regulator is to create incentives for bank to select safe project. Bank closure is the major instrument of bank regulation and often the only one. A credible threat of closure would preclude bank from investing into risky project.

The problem, however, is that the bank's choice is not observable to the. Instead, the regulator receives the information about the bank's choice, which contains some noise. Namely the regulator observes a variable $\varphi=\mu+\varepsilon$, where $\mu=\{1,0\}$: 1 for safe, 0 for risky, and ε is a random variable with zero mean with known probability density function f(x). The regulator does not have any view on the likelihood of risky or safe behavior of the bank *ex ante.*

After receiving the information about the bank's choice, a regulator decides whether to close the bank (preventive closure) or to leave it open. If the bank is closed by the regulator, the project is terminated at an early stage and depositors are paid back. If the bank chooses risky project and yet remains open, it becomes insolvent by the end of the period in the case risky investment fails to bring positive return. Then the bank will be liquidated under so-called forced closure procedure.

The cost of preventive closure for the regulator per one unit of deposits C_p is exceeds the cost of forced closure of insolvent bank C_f , i.e. $C_p \leq C_f$. For example, if the regulator bear the costs of paying back the depositors in case of a bank's failure $C_f=C_p+1$. The cost of closure for a bank is denoted by L, representing the value of banking license, which the bank will loose in the case of closure.

Figure. 3.1. The game tree



Matrix of expected payoffs for the game is given below:

Bank/Regulator	*Open (O)*	*Closure (C)*
Risky (R)	pr_r *- (1-p)L; - (1-p)·Cf,*	*-L;-*C_p

Safe (S)	$r_s;0$	$- L; -C_p$

The closure strategy of the regulator will be strictly dominated if:

$$\frac{C_f}{C_p} \leq \frac{1}{1-p} \tag{1.3}$$

If this is true the regulator will not close the risky bank, so this refers to *forbearance*, when bank remains open irrespective of its asset choice. For the following analysis we assume that it is optimal for the regulator to close the risky bank, that is:

$$C_p < (1-p)\cdot C_f \tag{1.4}$$

3.2 Perfect Bayesian Nash equilibrium

The solution to the above dynamic game of incomplete information is a perfect Bayesian Nash equilibrium. The probability that the regulator receives message φ if bank select a risky project is equal to:

$$p(\varphi|R) = p(\varepsilon = \varphi) = f(\varphi) \tag{2.1}$$

The probability that the regulator receives message φ if bank select a safe project is equal to:

$$p(\varphi|S) = p(\varepsilon = \varphi - 1) = f(\varphi - 1) \tag{2.2}$$

After receiving the message φ the regulator can assess conditional probability that the bank has selected a risky project (initial probabilities of safe and risky choice are assumed to be ½ and ½):

$$p(R|\varphi) = \frac{p(\varphi \mid R)}{p(\varphi \mid R) + p(\varphi \mid S)} \tag{2.3}$$

The regulator chooses to close the bank if cost of preventive closure is less than expected cost of the forced closure given conditional probability of the risky choice ($C \succ O$):

$$C_p < p(R|\varphi)\ (1-p)\cdot C_f + p(S|\varphi)\ 0 = p(R|\varphi)\ (1-p)\cdot C_f \tag{2.4}$$

As $p(R|\varphi)$ is not increasing in φ, this allows us to find a threshold level of $\overline{\varphi}$:

$$\overline{\varphi} : p(R|\overline{\varphi}) = C_p/(1-p)C_f \tag{2.5}$$

If the regulator receives a message below $\bar{\varphi}$ it will close the bank. The probability that a regulator will receive a message below the threshold level if a bank makes a risky decision is:

$$\bar{q} = p(\varepsilon \le \bar{\varphi}) = \int_{-\infty}^{\bar{\varphi}} f(x)dx \tag{2.6}$$

The probability that a regulator will receive a message below the threshold level if a bank makes a safe decision is:

$$\underline{q} = p(\varepsilon \le \bar{\varphi}-1) = \int_{-\infty}^{\bar{\varphi}-1} f(x)dx \tag{2.7}$$

Values $\bar{q}$ and $\underline{q}$ show the probabilities of preventive closure of the bank if it chooses risky or safe project respectively. It is obvious that $\bar{q} \ge \underline{q}$, so the safe behavior decreases the probability of being closed.

Expected payoff for a bank when risky project is chosen equals to:

$$EP(Risky) = -\bar{q}L + (1-\bar{q})[pr_r - (1-p)L] \tag{2.8}$$

Expected payoff for a bank when safe project is chosen equals to:

$$EP(Safe) = -\underline{q}L + (1-\underline{q})r_s \tag{2.9}$$

Bank chooses risky project if its expected payoff from it is greater than for safe project:

R $\succ$ S: $-\bar{q}L + (1-\bar{q})[pr_r - (1-p)L] \ge -\underline{q}L + (1-\underline{q})r_s$ (2.10)

that is

$$L \le \bar{L} = \frac{(1-\bar{q})pr_r - (1-\underline{q})r_s}{\bar{q} - \underline{q} + (1-\bar{q})(1-p)} = \frac{(1-\bar{q})pr_r - (1-\underline{q})r_s}{1-p-\underline{q}+p\bar{q}} \tag{2.11}$$

Bank will choose risky project if its losses in the case of closure are low. This result might explain the excessive risk-taking behavior of banks in transition, when the owners and managers of the bank do not incur sizable losses in case of a bank's failure and thus the value of the banking license is low.

3.3 The Case of Normal Noise Distribution

Suppose that ε is a normal random variable, which seems a natural assumption speaking about exogenous noise in the information received by a regulator. The probabilities that the regulator receives a message φ if bank is risky (safe) are:

$$P(\varphi|S)=\frac{1}{\sigma\sqrt{2\pi}}\,e^{-\frac{(\varphi-1)^2}{2\sigma^2}} \tag{3.1}$$

$$P(\varphi|R)=\frac{1}{\sigma\sqrt{2\pi}}\,e^{-\frac{\varphi^2}{2\sigma^2}} \tag{3.2}$$

Conditional probabilities that the bank has selected risky (safe) project are respectively:

$$P(R|\varphi)=\frac{e^{-\frac{\varphi^2}{2\sigma^2}}}{e^{-\frac{\varphi^2}{2\sigma^2}}+e^{-\frac{(\varphi-1)^2}{2\sigma^2}}}=\frac{1}{1+e^{\frac{2\varphi-1}{2\sigma^2}}} \tag{3.3}$$

$$P(S|\varphi)=\frac{e^{-\frac{(\varphi-1)^2}{2\sigma^2}}}{e^{-\frac{\varphi^2}{2\sigma^2}}+e^{-\frac{(\varphi-1)^2}{2\sigma^2}}}=\frac{1}{1+e^{\frac{1-2\varphi}{2\sigma^2}}} \tag{3.4}$$

The regulator prefers preventive closure if

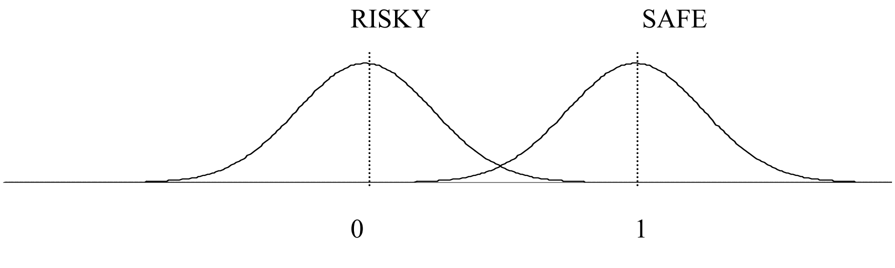
$$C_p < p(R|\varphi)(1-p)C_f + p(S|\varphi)\cdot 0=\frac{1}{1+e^{\frac{2\varphi-1}{2\sigma^2}}}(1-p)C_f \tag{3.5}$$

A threshold level of $\bar{\varphi}$ (a bank will be closed if $\varphi \le \bar{\varphi}$) is equal to:

$$\bar{\varphi}=\frac{1}{2}+\sigma^2\log\left[\frac{C_f(1-p)-C_p}{C_p}\right]=\frac{1}{2}+\sigma^2\log B \tag{3.6}$$

where $B=\frac{C_f(1-p)-C_p}{C_p}$ >0 if there is no forbearance.

Figure 3.2.



The probability of closure if risky project is chosen $\bar{q}$ is equal to:

$$\bar{q}=p(\varphi\le\bar{\varphi}|R)=\int_{-\infty}^{\bar{\varphi}}\frac{1}{\sqrt{2\pi}\sigma}e^{-\frac{\varphi^2}{2\sigma^2}}\,d\varphi \tag{3.7}$$

The probability of closure if safe project is chosen $\underline{q}$ is equal to:

$$\underline{q} = p(\varphi \le \hat{\varphi}|S) = \int_{-\infty}^{\hat{\varphi}} \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{(\varphi-1)^2}{2\sigma^2}} d\varphi \tag{3.8}$$

Bank chooses risky project if its expected payoff from it is greater than for safe project that is:

$$L \le \bar{L} = \frac{p(1-\bar{q})r_r - (1-\underline{q})r_s}{1-p-\underline{q}+p\bar{q}} = \frac{pr_r \int_{\hat{\varphi}}^{+\infty} \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{\varphi^2}{2\sigma^2}} d\varphi - r_s \int_{\hat{\varphi}}^{+\infty} \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{(\varphi-1)^2}{2\sigma^2}} d\varphi}{1-p-\int_{-\infty}^{\hat{\varphi}} \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{(\varphi-1)^2}{2\sigma^2}} d\varphi + p\int_{\hat{\varphi}}^{+\infty} \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{\varphi^2}{2\sigma^2}} d\varphi} \tag{3.9}$$

As in the previous sections the bank prefers a risky project to the safe one if does not value its license highly.

3.4 Regulator Interested in the Risky Project

A further extension to the model is the assumption that the regulator might be interested in the risky project. One of the examples of such a case is the situation that had place in Russia in 1995-1998. The CBR was responsible not only for banking supervision but for development of the GKO market as well. The latter served as a major source of funds for the government, and the regulator stimulated banks to invest into government domestic debts.

We assume that the regulator's payoff function includes its benefit (G) in case the bank implements a risky project (that is a bank chooses risky project and stays open). The matrix of the expected payoffs for the game is given below:

Bank/Regulator	*Open (O)*	*Closure (C)*
Risky (R)	pr_r - (1-p)L; -(1-p)·C_f+G,	-L;-C_p
Safe (S)	r_s;0	- L; -C_p

As was shown in section 3.2, the regulator chooses to close the bank if cost of preventive closure is smaller than expected cost of forced closure given conditional probability of the risky choice (C $\succ$ O):

$$-C_p > p(R|\varphi)\,[-(1-p)\cdot C_f + G] + p(S|\varphi)\,0 \tag{4.1}$$

Note that if risky project brings private benefit G to the regulator high enough it will cause forbearance. In this case the above inequality will never hold. The game then becomes an optimization problem of one player - the bank, and its results are trivial. Therefore for the further analysis we assume G<$(1-p)\cdot C_f$.

A threshold level of $\overline{\varphi}_G$ variable observed by the regulator is equal to:

$$\overline{\varphi}_G\text{: } p(R|\overline{\varphi}_G) = C_p/[(1-p)C_f - G] \tag{4.2}$$

As before, having received message below $\overline{\varphi}_G$ it chooses to close the bank. Not surprisingly, $\overline{\varphi}_G < \overline{\varphi}$ (see 2.5), that means that if the regulator is interested in the risky project it is ready to tolerate risky behavior of banks.

The probability that a regulator will receive a message below the threshold level if a bank makes a risky decision is:

$$\overline{q}_G = p(\varepsilon \le \overline{\varphi}_{/G}) = \int_{-\infty}^{\overline{\varphi}_G} f(x)dx \tag{4.3}$$

The probability that a regulator will receive a message below the threshold level (and consequently close the bank) if a bank makes a safe decision is:

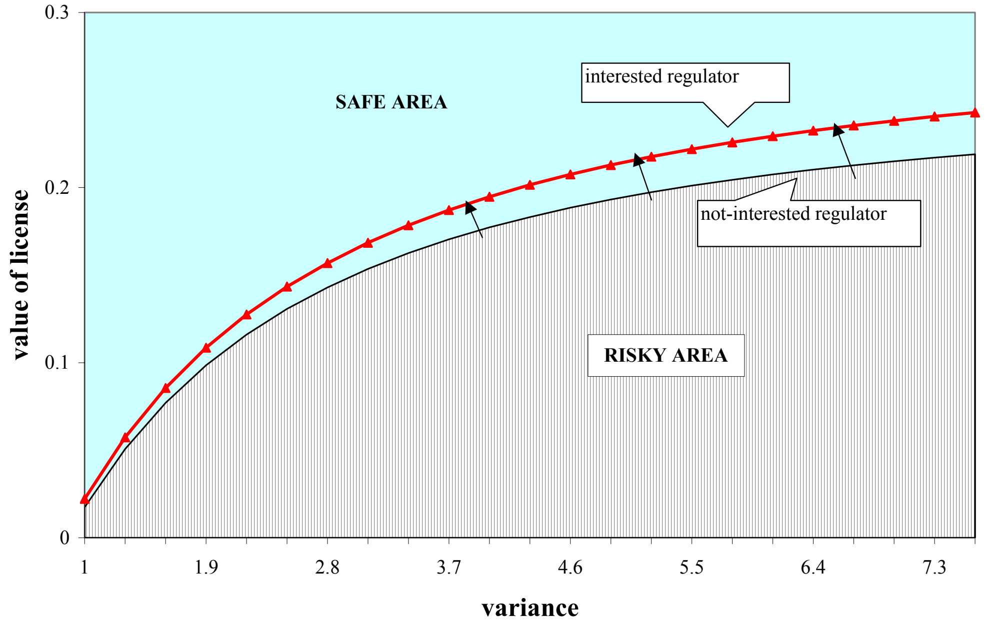
$$\underline{q}_G = p(\varepsilon \le \overline{\varphi}_G - 1) = \int_{-\infty}^{\overline{\varphi}_G - 1} f(x)dx \tag{4.4}$$

The bank will choose risky project if it does not value its banking license high enough:

$$L \le \overline{L}_G = \frac{(1-\overline{q}_G)pr_r - (1-\underline{q}_G)r_s}{\overline{q}_G - \underline{q}_G + (1-\overline{q}_G)(1-p)} \tag{4.5}$$

Distortion created by the regulator interest in the risky project is $\Delta = \overline{L}_G - \overline{L} \ge 0$. The value of the banking license that would prevent banks from excessive risk-taking is higher in the case the regulator has its private interest in risky project.

Figure 3.3.



3.5 Infinite Game

As it is shown above, value of banking license is an important parameter, which determines the behavior of a bank. In one-period game a value of banking license is an exogenous parameter. We can endogenize this parameter in a game with infinite number of periods, as the value of a license for a bank is simply a discounted value of its future profits. Let β to be a discount coefficient, $0<\beta<1$.

We assume that the game at each period starts with the bank choice between risky and safe project. The regulator is not sure about the bank's choice, just as in one-period game, instead it receives the information about bank's behavior, which contains noise, i.e. in period t it observes parameter φ_t. The regulator then decides whether to close the bank or to keep it open. If the bank is closed the game ends.

If the bank chooses a safe project and it is not closed by the regulator, it receives proceeds from its safe investment, pays back depositors and continues its operations in the next period. If the bank selects a risky project and it is not closed by the regulator (no preventive closure), then the future of the bank depends on the realization of its investment. If the bank is successful and its risky project brings positive return, the bank's depositors are paid back and the bank continues to operate in the next period. However, if the risky project fails the bank becomes insolvent and it is closed under forced closure procedure and the game ends. The payoffs from the safe/risky projects and costs of preventive and forced closure as well as expected payoff functions are the same as described in section 3.1.

Figure 3.4.

Period t

Bank chooses between {Risky; Safe}

Regulator does not observe the choice of the bank
instead it gets message φ_t containing noise. Regulator
chooses between {Open; Close}. If he chooses 'Close'
the game ends.

If the bank chose risky project and remained open,
nature decides whether the project was successful.
If not the bank is closed under the forced closure procedure.
In case the project was successful bank enters the t+1 period.

Period t+1

Bank chooses between {Risky; Safe}

Regulator receives φ_{t+1} and chooses between {Open; Close}

Nature determines the success of risky project if undertaken, etc.

An important feature of the model is that the regulator is uncertain about the choice of the bank even at the end of the period, unless the bank had selected risky project that failed. Moreover, if the regulator keeps the track of previous bank's behavior as suggested in Rubinstein-Yaari (1983) the threat to use that information would not be credible unless both agents are extremely patient. We will discuss the possibilities of usage past information below. According to the model assumptions, if the bank survives at the end of the period it is solvent by the beginning of the next period, as otherwise it would have been closed under forced closure procedure. Given that, the regulator's choice whether to close the bank or to leave it open in period *t* is entirely based on the information received in the period *t*, that is φ_t. The condition when the regulator prefers preventive closure is given by inequality (2.4). The threshold level $\bar{\varphi}$ is determined as in (2.5), and the probabilities of preventive closure by the regulator observing information φ if the bank makes safe/risky investment ($\bar{q}$ and $\underline{q}$) are calculated as in (2.6) and (2.7).

The bank however looks forward in the next periods as the choice of the risky project and higher probability of preventive closure may deprive bank of the future profits. Let us denote the discounted utilities of safe and risky choice for the bank as U_s and U_r. If a bank is not closed in period t, it will face exactly the same choice between Risky and Safe strategy in the period *(t+1)*. This logic allows us to estimate the discounted utility of the risky and safe choices under the assumption that these strategies are optimal:

$$U_r = \frac{(1-\bar{q})p}{1-\beta(1-\bar{q})p} r_r \tag{5.1}$$

$$U_s = \frac{(1-\underline{q})}{1-\beta(1-\underline{q})} r_s \tag{5.2}$$

The necessary condition for the safe project to be chosen is a sufficiently high discount factor or low discount rate ($U_s > U_r$):

$$\beta \geq \bar{\beta} = \frac{(1-\bar{q})pr_r - (1-\underline{q})r_s}{(1-\bar{q})(1-\underline{q})p(r_r - r_s)} \tag{5.3}$$

The above condition implies that if a bank has sufficiently high discount factor (β exceeds a threshold level $\bar{\beta}$), then bank attaches importance to future income flows. The optimal choice for a bank is therefore safe project, as it gives the bank more chances to stay open and receive future cash inflows. If a bank is short-term oriented with a low discount factor, it will choose risky project, which allows the bank to get high profits today at the risk of being closed. The threat of closure does not prevent the bank from risky behavior, as future profits are not important for the bank.

The major problem identified in the game described above is myopia of the regulator, which decides upon closing the banks based entirely on information received in the current period. Rubinstein-Yaari (1983) introduced the idea that if interaction between players is repeated indefinitely, the principal (the regulator) observes a large number of outcomes. In principle this might allow the regulator to make its choice with a greater precision and to punish the bank if it does not choose safe strategy more accurately, thus ensuring the credibility of closure threat. As long as the number of periods increases the law of large numbers can be applied. A challenging problem which arises in that kind of infinite principal-agent problems is how to choose threshold message which signals that the agent deviated from the strategy prescribed by the principal. Salanie (1997) suggested that the appropriate tool for this problem is the law of iterated logarithm, which bounds the large deviations from the law of large numbers. Following Salanie (1997) let *a* be any real number greater than 1, and

$$\delta_t = \frac{\frac{\left(\sum_{i=1}^{t} \varepsilon_i\right)}{t}}{\sqrt{\frac{2a\sigma^2 \ln \ln t}{t}}} \qquad (5.4)$$

The law of the iterated logarithm states that

$$\Pr(\limsup_{t\to\infty} \delta_t < 1) = 1 \qquad (5.5)$$

The appropriate policy for the regulator would be therefore to choose $a > 1$ and close the bank at period t if:

$$\left|\frac{1}{t}\sum_{i=1}^{t} \varphi_i - 1\right| > \sqrt{\frac{2a\sigma^2 \ln \ln t}{t}} \qquad (5.6)$$

Note that if the bank does choose safe strategy in each period then the probability of preventive closure will be vanishing. This allows us to solve the problem of a regulator not being able to not distinguish between risky and safe banks, which inevitable rises in one period game with increasing noise.

Thus we came to a crucial conclusion that long-living regulator can enforce long-run program of banking regulation and therefore the threat of punishment of risky banks would be credible. This implies that independent regulator is more efficient in supervising banks. This idea is especially important for transition economies because of intransparency and poor quality of information received by the regulator.

3.6 Model predictions

The resulting equilibrium in the game, i.e. the optimal choices of a bank and a regulator, depends on the set of exogenous parameters: rate of return on safe and risky project, the probability of positive return on risky project and costs of preventive and forced closure. The main predictions that follow directly from solution of the finite horizon model are as follows:

1. The regulator chooses forbearance strategy when the cost of preventive closure is high enough in comparison with the cost of forced closure. In this case a threat of closure is not credible and it does not affect the bank's choice.

2. The bank chooses safe project if it values its banking license highly. The result holds even when bank is operating in forbearance environment.

3. The bank chooses risky project if the probability of success on the risky project is high enough and the value of banking license is low. The result holds even if the bank does not expect forbearance from the regulator.

It is interesting also to analyze what is the impact of an increase in uncertainty on the threshold level of the value of banking license, preventing bank from risky behavior.

4. Accounting intransparency creates incentives for excessive risk-taking by banks. Namely the less transparent a bank is for the regulator, the more the bank should value its license to choose safe project.

The above prediction follows from the Proposition 1.

Proposition 1.

$\frac{\partial \overline{L}}{\partial \sigma} \geq 0$ if ε is a uniform, exponential or normal random variable.

Proof of proposition 1:

For the uniform and exponential distribution the proof is obvious. For the normal distribution see Appendix 1.

Introducing private benefit of the regulator in a risky project leads to the fifth prediction of the model:

5. Regulator privately interested in risky project is more likely to choose forbearance strategy thus stimulating excessive risk-taking by banks

Extending the model to infinite horizon provides us with one more important prediction:

6. Independent regulator is more efficient in supervising banks than shortsighted and dependent regulator, which can not enforce long-run program of banking regulation.

4 EMPIRICAL EVIDENCE

The model presented above explains development of the Russian banking sector and environment the bank operated in reasonably well. In our view, problems of Russian banks were caused mainly by their imprudent behavior rather than some macro-shocks. Based on the model predictions we develop testable hypotheses. We then test these hypotheses on the extensive data set, which includes banks' balances and profit&loss accounts presented to the regulator (CBR) on the quarterly basis for the period 1997-1999 as well as data on employment, and the fact of license withdrawal. The database includes all banks that provided their statements to the Central bank that is about 1400 -1500 banks per one date. The data are cleaned to meet requirements for consistency such as the sum of assets is equal to the sum of liabilities and equity, etc. (see Appendix for details on construction of the data set.)

4.1 Regulatory forbearance

4.1.1 Violation of prudential requirements

The first prediction of the model states that the regulator chooses forbearance strategy whenever cost of preventive closure of a bank is considerably higher than the so-called cost of forced closure, meaning the cost of closing a bank when it is already insolvent. Intransparent accounting rules create a scope for manipulation the accounting figures so that the regulator cannot distinguish between good and bad banks. Therefore the regulator will be reluctant to undertake a preventive closure due to a possibility to close a viable bank and thus loose a financial intermediary institution. In other words intransparency of accounting reporting increases the cost of preventive closure that may result in forbearance from the regulator side.

As noted by many practitioners of the banking industry, Russian accounting standards are extremely intransparent. Leaving the proof of this intransparency for the following section, now we would like to concentrate on the consequences it has for the behavior of the regulator in Russia. Thus we formulate the first testable hypothesis:

- Russian banks enjoyed regulatory forbearance as the CBR withdrew a license only after a bank has been violating prudential ratios for quite some time.

Empirical evidence provides strong support of this hypothesis. In 1998 more than 25% of working banks did not meet the requirement of sufficient capital, 40% had not enough current liquidity (known as Nn3 requirement of the Russian Central Bank) and even urgent liquidity was insufficient in 26% of banks (requirement Nn2). As of January 1, 1999 these figures though decreased (8.5%/30%/18% respectively) still remained quite high (see table 4.1). The figures in columns represent the number of banks, which violated the corresponding prudential requirement imposed by the CBR or even did not provide CBR with their ratios.

Table 4.1.
Number of banks with a valid banking license, which violate CBR prudential ratios

Date	Nn1 (capital adequacy)	Nn2 (urgent liquidity)	Nn3 (current liquidity)	Nn4 (long-term liquidity)	Nn5 (general liquidity)
1 Jan, 1998	427	439	659	315	528

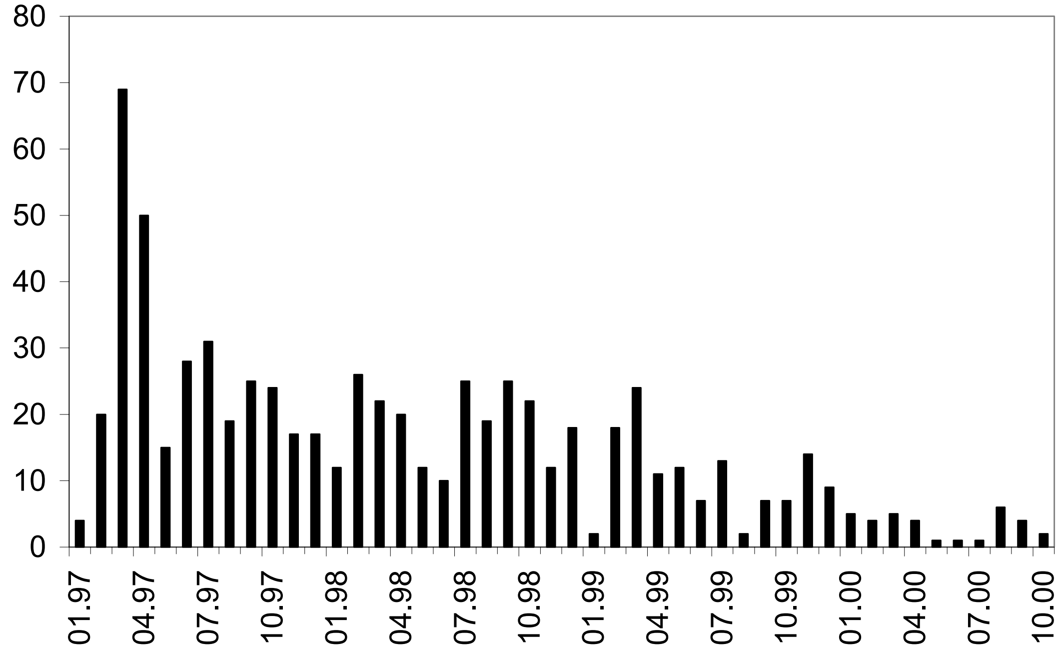
1 Jan, 1999	125	259	438	341	209
1 Jan, 2000	59	102	139	489	121

Nn1 - corresponds to the capital adequacy ratio shows whether a bank has sufficient amount of capital and is measured as a ratio of capital to total risk-weighted assets of the bank. This ratio should be not smaller than 8% or 9% depending on the absolute amount of own capital.
Nn2-Nn5 refer to various liquidity ratios defined as a ratio of liquid assets to bank's liabilities.
There are few other requirements designed by the CBR, but they are usually neglected by both banks and the regulator.

Studying the figures in the table one would notice that the greatest improvement was observed in meeting capital adequacy ratio (Nn1) after 1998. This is not surprising. On the one hand Russian banking sector was characterized by massive inflow of capital after the crisis with the main injections coming from the firms of the oil-exporting sector and other banks' owners with idle funds. CBR on its side made active effort to recapitalise the banking sector. On the other hand this statistics may be misleadingly optimistic as we expect that banks also improved their window-dressing skills.

To be fair we should note that the regulator revoked licenses from the most insolvent banks. The figure 4.1 illustrates that the regulator was the most active prior 1999. Nevertheless the process of clearing up was still too slow (IMF, 2000). The result was that despite the observed decline, the number of banks that violated prudential ratios still remained quite substantial.

Figure 4.1.
The number of licenses withdrawn by the CBR for the violation of prudential requirements.



Overall the environment in which Russian banks operated can be characterized as forbearance from the regulator's side. Thus the regulator stated the rules of the game (prudential requirements) but did not follow them tolerating their violation. The banks had no clarity regarding the regulator's behavior in different contingencies. The following section is aimed at illustrating that indeed regulator based its decision upon banks' closure on discretion rather than the rule.

4.1.2 Discretionary closure policy

Prudential requirements defined by the regulator are the guidelines for banks' behavior: a bank that violates these directives should be closed and the bank will stay operating in case it obeys them. In reality, however, violation of prudential requirements was not necessarily followed by timely license withdrawal and therefore banks were deprived of clear guidelines for their behavior. Thus, we would expect to see that only few prudential ratios really affected the regulator's decision to close the bank while many of the requirements were redundant. Let's consider a simple model when the regulator makes decision upon bank's closure basing on the information about legally imposed prudential ratios. Putting this in econometric terms renders the following logit model:

Prob(license withdrawal) = F(Nn1, Nn2, Nn3,..., Nnk)

Table 4.2.
Logit estimations.

License withdrawal	1998	1999	2000

Nn1 (capital adequacy)	0.75**	1.01***	-0.59
Nn2 (urgent liquidity)	0.43	2.43***	1.77**
Nn3 (current liquidity)	1.67***	-0.33	1.94**
Nn4 (long-term liquidity)	-0.01	-0.14	..
Nn5 (overall liquidity)	1.33***	0.94**	..
Moscow	-0.6**	0.39	3.55***
Gosbank	-0.55	0.30	0.11
Const	-3.31***	-4.06***	-7.39***
Number of obs.	1201	1134	1280
Log likelihood	-275	-203	-75
Pseudo R2	0.35	0.26	0.24

Dependent variable equals to 1 if license was withdrawn within 1 year after the reporting date and zero otherwise.
All explanatory variables are binary.
Nni = 1 if *i*-th prudential ratio was violated by the bank.
Moscow is a dummy for bank located in Moscow
Gosbank is a dummy for bank being previously involved in the Gosbank system.
For the end of 1999 variables Nn4 and Nn5 were omitted because most of the banks failed to provide the CBR with these prudential ratios and it reduced the number of observations dramatically.

Presented results of the logit estimations show that indeed not all the prudential ratios affected the regulator's decision to close the banks, as some of the coefficients appeared insignificant. Furthermore, some prudential requirements while significant on some dates became insignificant on another, which represents a clear evidence of the regulator's discretion. After the crisis the short-term liquidity coefficients became more important while capital adequacy ratio lost the gear by the year 2000. This is not surprising, as short-term liquidity ratio is the most transparent characteristic among the all as contrary to the capital item it is less susceptible to accounting manipulations (see Intransparency section below). Thus empirical evidence witnessed that the regulator chose whether to close a bank basing on the bank’s liquidity position rather than its solvency (Nn2 becomes significant after the crisis).

4.2 Intransparency of financial reporting

The forth prediction of the theoretical model states that accounting intransparency creates incentives for banks' imprudent behavior. This is consistent with the view expressed before that intrasparency of financial reporting is one of the factors that increases the cost of preventive close thus leading to regulatory forbearance. Formally the testable hypothesis rendered by the forth prediction of the model, can be formulated as:

- Russian banks operate in environment characterized by extremely intrasparent financial reporting, which gives room for manipulation of figures reported.

In this section we present evidence of intransparency of Russian accounting standards in comparison with international ones. We start from presenting for comparison the aggregated balance sheets of banking sector in Russia and USA. Major activities of banks are reflected in their balance sheet. Therefore by comparing aggregate balance sheets for Russian and a developed Western banking system we can trace differences of behavior of a typical bank in the two banking systems.

Table 4.3.

Aggregate balance sheet of Russian and US banks, as % of total assets

ASSETS	US	RUSSIA	LIABILITIES	US	RUSSIA
Cash reserves and balances	4	20	Current accounts, of those	23	22
Market loans	6	4	State and state-owned firms	NA	6
Securities, of those	24	18	Deposits, of those	45	10
Government securities	19	7	Private	20	8
Non-gov. securities	5	11	Market borrowings	24	11
Loans, of those	59	35	Arrears to clients	0	5
Loans to state	0	3	Other liabilities	0	11
Loans overdue	NA	8			
Fixed assets and miscellaneous	7	15	Capital and reserves	8	40
Other assets	0	4			
Losses	0	4			
TOTAL	100	100	TOTAL	100	100

Source:
for US: Mishkin, The economics of money, banking and financial markets, p.252
for Russia: own calculations.

Although aggregation hides some characteristics of individual banks (which will be studied in further analysis) besides the differences in accounting standards and financial system structure do not allow us to make perfectly comparable breakdown of the balance sheet, it is still possible to reveal some striking differing facts.

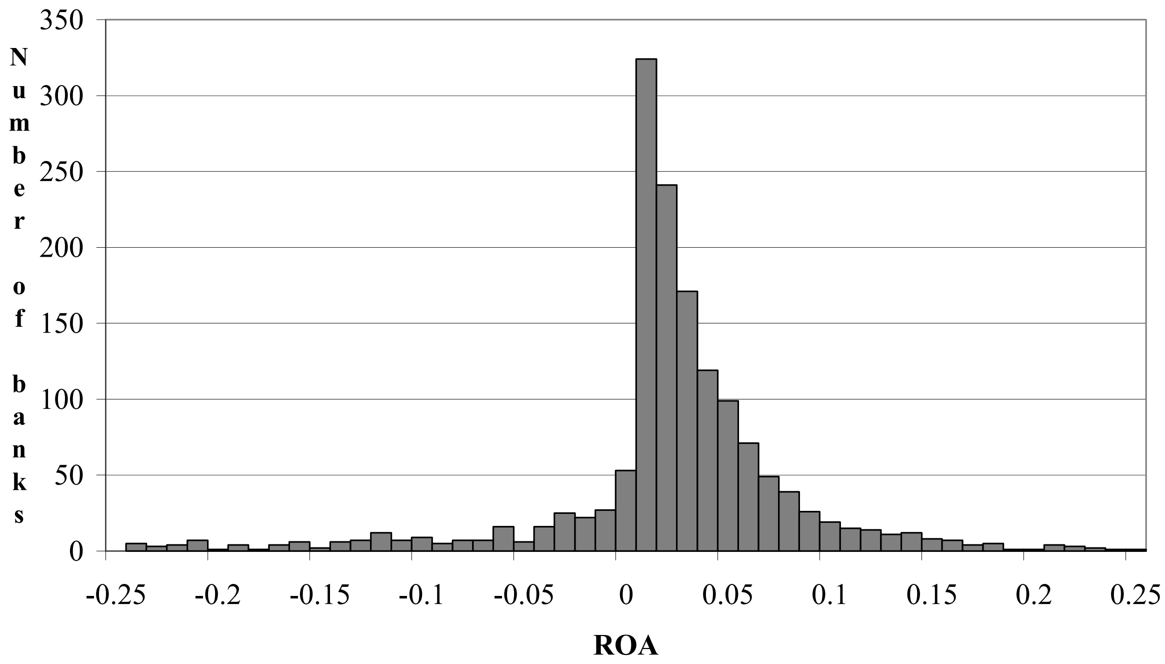
First of all such items of the balance sheet as 'loans overdue' and 'arrears to clients' are the exclusive feature of Russian banking reporting. Note that both these figures are non-negligible: they constitute 8% and 5% of total assets respectively. However, the notion of overdue loans and arrears to clients while accounted differently are still familiar to the Western accounting as well. The existence and size of unidentified items such are 'other assets' and 'other liabilities' (accounting for 4% and 11% of total assets respectively) evidence even more blatant intransparencies of the accounting standards employed in Russia. More of it as the anecdotal evidence goes sharp increase of the other assets item often reflects on-going process of asset stripping away from the bank (see Appendix 4).

However the most strikingly diverges 'capital and reserves' item of American and Russian banks. Bank capitalization is one of the most important characteristics. The role of capital cushion is in absorbing losses and protection of bank’s creditors. Adequate capitalization is a prerequisite for restoring trust in bank's ability to meet its obligations in the case of a short-term bank run. It may help to stop bank panic and prevent an illiquid bank from becoming insolvent. The fundamental difference between the qualitative meaning of bank capital in Russian and Western accounting standards stems from the difference in balance sheet construction. Western accounting standards define capital as a difference between the market value of assets and liabilities of a bank. According to the Russian accounting standards bank's losses are shown on the asset side of a balance sheet. Therefore due to the accounting identity the capital shown on the liability side of a balance sheet is automatically increased by the amount of losses and therefore is overestimated. Hence, the enormous figure of own capital as a share of total assets for Russian banks (40%) is misleading because Russian banks are clearly undercapitalized. Nevertheless even if we recalculate capital for Russian banks subtracting reported losses to make it more comparable with the western accounting standards, the average figure is be 29% of total assets, i.e. 3.5 times greater than for the US banks. The reason for this is that banks are reluctant to show their actual losses underreporting them. Consequently some part of bank's losses is hidden in its assets and the latter is overestimated resulting in artificially high figures for capital.

Leaving aside for the moment balance sheet and looking at the profit and loss account reported by banks could provide some curious results as well.

Figure 4.2.

Breakdown of the return on assets for the year 1999.



It has already become a conventional wisdom that official figures for profits in Russian companies are the most manipulated and thus unreliable ones. The figure 4.3 illustrates that Russian banking industry is not an exclusion in this respect. By the end of 1999 over total of 1732 banks that submitted profit&loss accounts more than 63% had profits in the interval [-5%;5%]. The largest number of banks have profits slightly above zero (618 banks out of 1732 report profits greater than zero but less than 2% of their assets) which brings us to a conclusion that Russian banks can easily manipulate profits targeting at a certain desired level.

Summing up, there were many banks that violated prudential ratios and still held the valid banking license. This means that the CBR did not use the method of preventive closure when regulating banks. In the framework of our theoretical model this implies that the cost of preventive closure was indeed prohibitively high and therefore the threat of it was not credible. In practice intransparent accounting increased the cost of preventive closure. Banks could manipulate reporting figures with the figure for capital being of the main concern. As a result, the regulator followed discretion rather than rule when making decision upon bank's closure.

4.3 Regulator Having a Private Interest in Risky Project

This section refers to the extension of the theoretical model when we introduce the possibility of a regulator being privately interested in banks' participation in risky project. There are two main cases when Russian regulator could be considered as having a private interest in bank's risky projects. Affiliation of Russian banks with government and state-owned enterprises is the first one.

4.3.1. Bank's affiliation with the state

Russian banking sector in the 90s was characterized by close affiliation of many banks with the state inherited from soviet times through personal contacts and/or Gosbank system. In addition even newly emerged banks tried to get connections with government at all levels to get access to relatively cheap money: serving non-interest bearing or low interest bearing state's transaction accounts brought to a bank short-term profits. Besides holding the state accounts brought the bank non-pecuniary benefits in the form of connections, recognition, and reputation. In return the state demanded from a bank to provide loans to strategic enterprises, fill the gaps of funds needed to pay salaries, etc.; this was especially true of regional banks. Notion of soft budget constraints, which was widely studied in literature on transition (see for example Dewatripont and Maskin, 1995), explains the relation between the state and an affiliated bank. Government affects the banks to give out loans to state-owned or strategic enterprises; for instance in the case when the whole city or a region is dependent on a single enterprise and therefore its bankruptcy would have too serious social consequences. Banks may be willing to provide loans to ex ante inefficient state-owned enterprises hoping for the bail out ex post. We should note here that while formally Russian Central Bank was an independent institution, in reality its dependence with the state was very high. Therefore it seems appropriate not to draw a line between interests of the state and the Central Bank.

Let's consider the behavior of the CBR after the crisis. One of the functions of a regulator is to act as a Lender of last Resort for banks, in other words to provide emergency liquidity support to illiquid but solvent banks. Although there is some correlation between bank's insolvency and illiquidity, the ultimate decision of bank's closure should be based in its insolvency. According to the data set, the CBR as a lender of last resort provided Russian banks with total of more than R27 bn over the period of 1997-1999 just in the form of explicit loans. Of those 114 banks that received the support 25 later lost their licenses. These insolvent banks received more than 43% of total credits. Also of these same 114 banks 18 can be identified as having state affiliation. These banks close to the state accounted for more than 66% of CBR's credits.

One of the cases of a 'strategic' enterprise is a so-called too-big-to-fail firm. Our data evidenced that such consideration was an important factor affecting the CBR's choice of its support recipients. (Mailath and Mester (1994) provided a theoretical support for too-big-to-fail phenomena by making cost of bank's closure dependent on its size).

Table 4.4.

Loans from the LOLR (CBR) as % of total assets.

Banks' size	Loans from the CBR as % of total assets
20 largest	1.3
21-100	0.4
101-200	0.1
Other	0.03

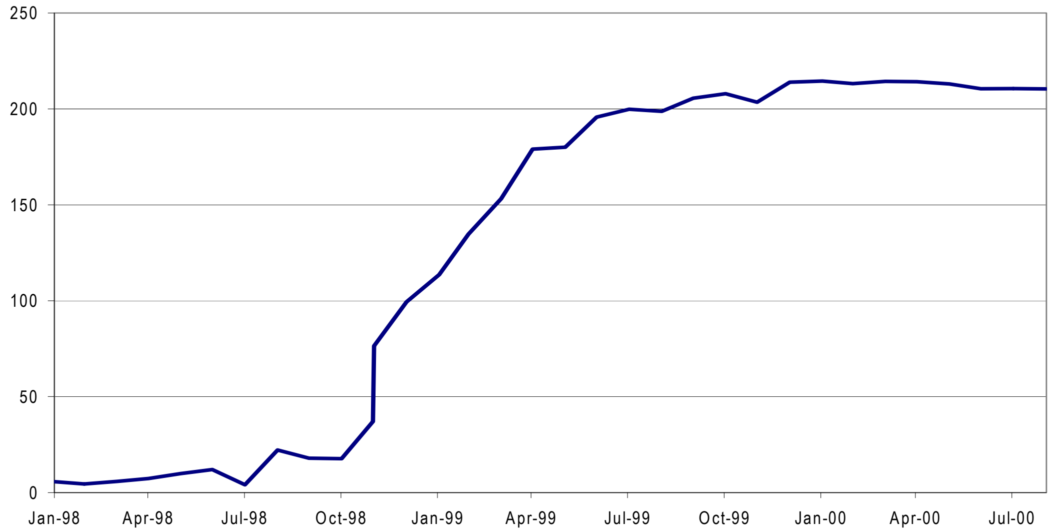
As shown in the table 4.4, the larger a bank was the more funds it received from the CBR. The difference is even more striking if we consider the figures in money terms rather than as shares of assets.

4.3.2. Bank's participation in GKO market

The second practical examples of theoretical construction when the regulator is interested in a risky project is the example of GKOs market prior the 1998 crisis in Russia. Although the issuer (Ministry of finance) formally differed from the regulator (Russian Central Bank), in reality close affiliation between the two resulted in synchronization of their interests.

The empirical evidence goes that the larger was the GKO portfolio of a bank the more funds it received: the correlation between the size of the CBR loan and amount of money invested in GKO was 89% as of July 1998 for the banks that received the support (excluding Sberbank and Vneshekonombank to avoid size effect). The importance of the involvement in the GKO market was even greater than our data indicates. In addition to the explicit credit, the CBR bailed out banks that suffered from the GKO default by providing them implicit subsidy via purchase of their GKO portfolio at par value through REPO-agreements. The figure 4.3 shows the rapid growth of funds providing by the CBR to commercial banks through REPO-agreements after the crisis till mid-1999.

Figure 4.3.
Funds provided by the CBR to commercial banks, including claims on REPO agreements, R bn



Thus, it seems that the CBR did not perform efficiently its LOLR function. Majority of the funds flew to the banks that were affiliated with the state either through holding its accounts or via participation in the GKO market. Banks closely affiliated with the state received liquidity support from the CBR and banks involved in government securities market were bailed out after the default on domestic debt market. In the framework of our theoretical model it implies that regulator that was interested in risky project supported banks, which were involved in this project.

4.4 Risk-taking by banks in Russia

As the theoretical model predicts, a bank will choose risky project if the threat of closure is not credible (regulatory forbearance). Furthermore, even in no-forbearance environment bank may prefer to undertake risky project if the discount factor is high and consequently value of banking license low.

The preceding sections presented evidence in favor of the view that Russian banks operated in forbearance environment. In addition we argue that value of banking license was extremely low not only due to very high discount factor but also because of low entry costs in banking sector Russia. Coupled with weak prudential supervision, this resulted in excessive risk-taking by Russian banks.

Major activities of banks are reflected in their balance sheet. The comparison of the combined balance sheets (table 4.3 section 4.2) of the Russian and American banks allows us to infer general perception of the level of banks involvement in risky operations in the two countries. According to conventional theory of banking supported by historical evidence, traditional banking can be considered as the safest type of banking activity. By saying ‘traditional banking’ we imply collecting personal deposits and providing loans with careful assessment of the creditworthiness of the borrower, in other word banks acting as intermediaries between those with excess funds and those with current lack of funds. Data in the table 4.3 capture the fact that unlike American banks their Russian counterparts are much less involved in traditional banking operations. i.e. in safe projects. This is reflected in small share of loans on the assets side of the balance sheets (59% for US vs. 35% in Russia) and relative unimportance of deposits as sources of finance (45% and 10% respectively). Figures for current accounts are roughly the same in both countries (slightly greater than 20%) and this reflects that Russian banks do provide payment services but not intermediation services. Now we turn to consideration of micro-characteristics of banking in course of Russian transition.

4.4.1 Micro-economic characteristics of risk-exposure of Russian banks.

The aggregate notion of risky strategy employed in the theoretical model has various practical implications. It is possible to distinguish between different types of risks the banks are exposed to, the most important being the risk of default or credit risk.

In reality there were differences between banks on micro-level that determined exposure to a particular risk of a certain bank. The main micro-characteristics of a bank are its size, location, affiliation with the state, its involvement in traditional banking activity and, finally, current and previous financial position of a bank. All of these factors would influence the willingness of a bank to undertake risky projects.

Russian banking industry was characterized by relatively low exit and entry costs in the Russian banking industry and limited liability of banks' owner. Consequently the owners of a falling banks always had an option of moving assets to a newly established bank. Therefore it is logical to expect that banks in a poor financial condition would be less careful with regards to their credit risk, especially if a bank can consider itself as a too-big-too-fail.

According to classic investment theory short-term instruments *ceteris paribus* have a lower default risk than instruments with a longer term to maturity. Uncertainty regarding future inflation and substantial political risk, which were salient features of Russia in the 90s, made the maturity characteristic of a financial instrument crucial one. Therefore short-term loans are considered to be relatively safe assets and therefore would result in lower credit risk exposure. On the contrary, long-term loans are highly risky and even suspicious investment opportunities.

Besides, the conventional banking theory implies that combining provision of payment and financial intermediation services is beneficial for a bank. The idea behind is that servicing firms' transaction accounts provides the bank with private information about potential borrowers and therefore reduce the problems of adverse selection and moral hazard stemming from information asymmetries. Thus we would expect that holding transaction accounts reduce credit risk for a bank.

Impact of affiliation with the state on the bank's efficiency was discussed above in great details. Summing up the reasoning presented in the section 4.3.1, close affiliation with the state may bring a bank short-term benefits, however, it adversely affects effectiveness of the bank's operations in the long run and results in higher level of bad loans. There are plenty examples when servicing of state accounts led to a rapid growth of the bank's assets and enhancement of position of the bank in banking society which was followed by immediate decline and failure of the bank as soon as the state funds were withdrawn.

To test importance of a particular micro-economic characteristic of a bank for its credit risk exposure the following regression were estimated for two cross-section periods and panel random effect regression for 1998-2000 (all variables are taken per one worker to escape pure size effect. L(.) – indicates lag operator):

- ❑ Loans overdue = β1* L(Loans to the state) + β2*L(Loans to the state-owned enterprises) + β3*L(Long-tem loans to private firms) + β4*L(Short-tem loans to private firms) + β5*L(State Accounts) + β6*L(Firms Transaction accounts) + β7*Set of Dummies + Constant

Table 4.5 summarizes testable hypothesis regarding micro-characteristics of banks' credit risk exposure; it also presents the results of empirical testing of this hypothesis.

Table 4.5.
The influence of banks' micro-characteristics on a bank's exposure to credit risk.

	Expected	Actual
Loans to state-owned enterprises	+	+
Short-term loans to private enterprises	-	?
Long-term loans to private enterprises	+	+
Current accounts of private enterprises	-	-
State current accounts	+/-	+
Size	+	+
Moscow	-	-
Gosbank	+	+

The regression results are consistent with the view that government affiliation lead to greater loan losses and so does the provision of longer-term loans. On the other hand, access to private information about the borrowers through servicing transaction accounts reduced banks' credit risk exposure (see Appendix 3, Table 3.4 for details). In addition, regional banks were more exposed to credit risk compared to those located in Moscow. This fact can be explained by greater dependence of banks on the will of municipal governments.

Apart from credit risk the foreign currency and derivatives risks were studied. The regression analysis shows that banks involved in traditional banking (i.e. with higher share of transaction accounts in total liabilities) were engaged in derivatives speculations to a lesser extent. On the contrary the banks with smaller capital level were higher exposed to derivatives risks, possibly gambling for resurrection, and so were risky banks with large GKO portfolio just before the crisis (see Appendix 3, Table 3.6 for details).

In addition banks with larger accumulated government debt were more exposed to foreign currency risk. Average open currency position were equal 4.3% of total assets for banks with large GKO holdings versus 1.5% overall. The maximum of open currency position for banks involved in GKO speculations was as much as 54%. More than 10% of banks that were significantly involved in the government debt market, had open currency position exceeding 20% of their assets (see Appendix 3, table 3.5 for the details). The following scheme can explain this finding: a bank obtained foreign currency denominated liabilities characterized by low interest rate and then invested further in the GKO market aiming at high profits provided by this market. Default on the domestic debt market coupled with severe devaluation of the rouble resulted in huge losses for such banks.

Asset stripping is the extreme case of risk-taking in a bank that foresees the inevitable failure in observed future. Akerlof and Romer (1993) introduced the notion of bankruptcy for profit. They argue that if economic value of a bank (that is discounted future profits) is less than the current value of its assets, there are incentives for a bank's owner to strip assets from the banks thus looting the bank's depositors. Akerlof and Romer developed a theoretical framework for this idea and provided anecdotal evidence for some failed banks that went bankrupt at the course of S&L crisis of the 1980s in the US. We view assets stripping as the extreme case of risky behavior of a bank, which foresees inevitable failure.

Naturally it is very difficult to detect asset stripping based on bank's official statement. However as anecdotal evidence goes it is possible to infer two proxies for stealing of assets: unclassified assets and loans to non-financial non-residents. The data shows that as the day of license withdrawal approaches the level of unclear assets increase (see Appendix 3, Table 3.7). The pace and pattern of stealing assets most probably is individual for every bank that ever did it since the bank cannot predict the day of license withdrawal with certainty due to the regulatory discretion. As anecdotal evidence we present graphs of unclear assets over time for 6 banks with withdrawn licenses (see Appendix 3, Figure 3.1). While it is difficult to render any systematic pattern of movement, the share of unclear assets in every case has already reached its maximum to the day of license withdrawal.

Summing up, the process of problem accumulation in a failed bank can be broadly divided into two stages. Initially bank's losses follow from unsuccessful investment decisions or inefficiency of regular banking operations (high costs and low revenues) even if a bank was prudent. It can be the result of inexperience of a manager or poor average quality of borrowers. On the other hand low profit margins and regulatory forbearance created incentives for banks' risky behavior and not careful asset management resulting in further losses. The more losses a bank has, the worse its financial position is. This brings up a problem of moral hazard when mangers' incentives had changed over time. Namely given limited liability and poor contract enforcement, bank owners have incentives to hide remaining assets. This is the second stage of bank's evolution characterized by massive asset stripping that leads to fast deterioration of the bank. Losses and bank insolvency in this case is the conscious choice of the bank owners. In reality timing of entering each of the stages and actual implication of the outlined process of assets stripping was unique for each bank.

5 CONCLUSION

The paper studies the interaction of a bank and a regulator in transition environment. In the paper we argue that problems accumulated on the micro-level are more important for bank's bankruptcy rather than macroeconomic shocks. The paper studies reasons for banks' risky behavior as well as analyses optimal strategy of a regulator in transition.

A game theory model of incomplete information serves as a theoretical framework, which captures the most important features of transition environment relevant to banking industry: intransparent accounting rules, high discount factor and low value of banking license. In addition the model introduces a feature, which was peculiar to Russia - a possibility for regulator to have private interest in a risky project. We believe that GKO market was one of the examples of such a situation. The model renders a number of important predictions regarding behavior of a regulator and banks in transition environment. These predictions found statistical support in the data available and they result in a number of policy implications.

The model predicts that the regulator cannot credibly commit to close a bank that chooses risky strategy, which would be an optimal strategy. The reason for it is high cost of closing a risky yet viable bank, i.e. cost of so-called preventive closure. The intrasparency of financial reporting exacerbates the problem since the regulator cannot distinguish between safe and risky banks with certainty. Given that, the optimal strategy for the regulator is forbearance. Knowing this, banks choose risky strategy, which may bring higher return though with smaller probability of success. However, value of banking license is an important factor that determines bank's risk-exposure. Even when bank is operating in forbearance environment, it may choose safe project if it values its banking license highly. On the other hand a bank will choose risky project even if there is no forbearance in case when the value of license is low and the probability of success on a risky project is relatively high. The less transparent is financial reporting the greater a bank should value its license to prefer safe project. Introducing private interest of the regulator in a risky project brings distortion in the outcome by increasing the area where forbearance strategy is optimal for the regulator.

Empirical testing confirms that Russian regulator followed forbearance policy prior the 1998 crisis and right after it. Many banks violated prudential ratios yet holding valid banking licenses. Consequently when making decision upon bank's closure, the regulator followed discretion rather than a rule. Banks closely affiliated with the state received liquidity support from the CBR and banks involved in GKO market were bailed out after the default on domestic debt market. Besides the too-big-to-fail consideration was important for the regulator when choosing the recipients of its support.

Quite logically study of micro-economic characteristics of banks' risk exposure reveals that banks closely affiliated with the state were more carefree in the sense of greater credit risk exposure. The affiliation with the state could be in the form of holding state's transaction accounts and/or providing loans to state-owned enterprises or it could be connection with the state inherited from the soviet times' Gosbank system. Holding a large portfolio of GKOs may serve as another example of affiliation with the state. Banks, which were active players on the risky GKO market just before the crises, were also extremely exposed to currency and derivatives risk. In addition we found that banks in poor financial condition exposed themselves to credit risk more than viable banks. Indeed bank managers having no personal responsibility in case of bankruptcy had no incentives to save failing bank. They could shift assets away from the bank. Anecdotal evidence serves in favor of view that asset striping is the marginal case of risk-taking. Overall traditional (relatively safe) banking was much less widespread in Russia than in a typical developed banking system, as the comparison of aggregate balance sheets evidences. At the micro-level, however, banks involved in traditional banking were more prudent exposing themselves to credit risk as well as to currency and derivatives risks to a lesser extent.

The results of the paper call for certain policy implications. The most important are as follows:

- Improving of financial reporting is crucial for making bank regulation more efficient. Introducing International Accounting Standards (IAS) would make reporting more transparent. Calculation of bank's capital according to IAS is the top priority measure as capital is the most misleading figure in the balance sheet of a Russian bank.
- Independent regulator is more efficient in regulating banking industry. In this respect the latter development of transformation of the Russian Central Bank into a government institution seems inappropriate.
- Law on bankruptcy of banks, which would give clear criteria for license withdrawal, should be adopted. This law should be strictly followed, as the implementation of it is not less important than its adoption.
- Introducing personal responsibility of bank managers would increase exit costs and create incentives for more prudent behavior. Relevant legislation regarding this should be adopted.

- Competition in the banking industry should be enhanced and the state involvement reduced to a minimum. This can be attained under completion of Federal Treasury system so that all government account will be held with the Treasury but not with commercial banks. Naturally the monopoly of Sberbank in retail banking should be eliminated through phasing out its exclusive deposit insurance coverage.

Note that another important implication of the model is that administrative measures alone do not suffice to create incentives for banks being prudent. Existence of safe financial instruments and greater macroeconomic stability would decrease discount factor and make banks value their license. If this is attained the model predicts that banks would prefer safe behavior regardless of the strategy of the regulator.

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APPENDIX 1.

PROOF OF PROPOSITION 1.

Proposition 1.

$\frac{\partial \bar{L}}{\partial \sigma} \geq 0$ if ε is a uniform, exponential or normal random variable.

Proof of proposition 1:

A. Uniform distribution

$$\bar{L} = \frac{(1-\bar{q})pr_r - (1-\underline{q})r_s}{1-p-\underline{q}+p\bar{q}} = \frac{(1-\frac{1}{2\sigma})pr_r - r_s}{1-p+p\frac{1}{2\sigma}} \qquad \text{(A1)}$$

For the uniform distribution the proof is obvious. L is increasing function in σ as the nominator is increasing and the denominator is decreasing in σ.

B. Exponential distribution

$$\bar{L} = \frac{p(r_r - r_s)}{2e^{\frac{1}{2\sigma}}B^{\frac{1}{2}} - B - p} - r_s, \quad \textit{where} \quad B = \frac{C_f(1-p) - C_p}{C_p} \qquad \text{(A2)}$$

For the exponential distribution the proof is obvious as the denominator of the first part of the formula is decreasing in σ.

C. Normal distribution

$$\bar{L} = \frac{p(1-\bar{q})r_r - (1-\underline{q})r_s}{1-p-\underline{q}+p\bar{q}} = \frac{pr_r \int_{\varphi}^{+\infty} \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{\varphi^2}{2\sigma^2}} d\varphi - r_s \int_{\varphi}^{+\infty} \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{\varphi-1^2}{2\sigma^2}} d\varphi}{1-p-\int_{-\infty}^{\varphi} \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{\varphi-1^2}{2\sigma^2}} d\varphi + p\int_{\varphi}^{+\infty} \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{\varphi^2}{2\sigma^2}} d\varphi} \qquad \text{(A3)}$$

We need to prove that $\partial \bar{L} / \partial\sigma \geq 0$.

Calculation of derivatives for $\overline{q}$ and $\underline{q}$ gives:

$$\frac{\partial \overline{q}}{\partial \sigma} = \left(\int_{-\infty}^{\overline{\varphi}} \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{\varphi^2}{2\sigma^2}} d\varphi \right)_\sigma^{/} = \left(\int_{-\infty}^{\overline{\varphi}/\sigma} \frac{1}{\sqrt{2\pi}} e^{-\frac{\varphi^2}{2}} d\varphi \right)_\sigma^{/} = \left(\frac{\overline{\varphi}}{\sigma} \right)_\sigma^{'} \frac{1}{\sqrt{2\pi}} e^{-\frac{\overline{\varphi}^2}{2}} \quad \text{(A4)}$$

and

$$\frac{\partial \underline{q}}{\partial \sigma} = \left(\int_{-\infty}^{\overline{\varphi}} \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(\varphi-1)^2}{2\sigma^2}} d\varphi \right)_\sigma^{/} = \left(\int_{-\infty}^{(\overline{\varphi}-1)/\sigma} \frac{1}{\sqrt{2\pi}} e^{-\frac{\varphi^2}{2}} d\varphi \right)_\sigma^{/} = \left(\frac{\overline{\varphi}-1}{\sigma} \right)_\sigma^{'} \frac{1}{\sqrt{2\pi}} e^{-\frac{(\overline{\varphi}-1)^2}{2}} \quad \text{(A5)}$$

$$\frac{\partial \overline{L}}{\partial \sigma} = \frac{(p(1-\overline{q})r_r - (1-\underline{q})r_s)_\sigma^{'}(1-p-\underline{q}+p\overline{q}) - (1-p-\underline{q}+p\overline{q})_\sigma^{'}(p(1-\overline{q})r_r - (1-\underline{q})r_s)}{[1-p-\underline{q}+p\overline{q}]^2} =$$

$$= \frac{N_1}{[1-p-\underline{q}+p\overline{q}]^2} \quad \text{(A6)}$$

We need to prove that the nominator N_1 is more or equal to zero ($N_1 \geq 0$).

$$N_1 = \frac{1}{\sqrt{2\pi}}[-pr_r\left(\frac{\overline{\varphi}}{\sigma}\right)_\sigma^{'} e^{-\frac{\overline{\varphi}^2}{2\sigma^2}} + r_s\left(\frac{\overline{\varphi}-1}{\sigma}\right)_\sigma^{'} e^{-\frac{(\overline{\varphi}-1)^2}{2\sigma^2}}][1-p-\underline{q}+p\overline{q}] -$$

$$-\frac{1}{\sqrt{2\pi}}[p(1-\overline{q})r_r - (1-\underline{q})r_s][p\left(\frac{\overline{\varphi}}{\sigma}\right)_\sigma^{'} e^{-\frac{\overline{\varphi}^2}{2\sigma^2}} - \left(\frac{\overline{\varphi}-1}{\sigma}\right)_\sigma^{'} e^{-\frac{(\overline{\varphi}-1)^2}{2\sigma^2}}] =$$

$$= \frac{1}{\sqrt{2\pi}}(r_r - r_s)p\left((1-\overline{q})\left(\frac{\overline{\varphi}-1}{\sigma}\right)_\sigma^{'} e^{-\frac{(\overline{\varphi}-1)^2}{2\sigma^2}} - (1-\underline{q})\left(\frac{\overline{\varphi}}{\sigma}\right)_\sigma^{'} e^{-\frac{\overline{\varphi}^2}{2\sigma^2}}\right) = \frac{1}{\sqrt{2\pi}}(r_r - r_s)p \cdot N_2 \quad \text{(A7)}$$

We need to prove that $N_2 \geq 0$:

$$N_2 = (1-\overline{q})\left(\frac{1}{2\sigma^2} + \log B\right) e^{-\frac{(\overline{\varphi}-1)^2}{2\sigma^2}} - (1-\underline{q})\left(-\frac{1}{2\sigma^2} + \log B\right) e^{-\frac{\overline{\varphi}^2}{2\sigma^2}} =$$

$$= e^{-\frac{(\overline{\varphi}-1)^2}{2\sigma^2}} \frac{\overline{\varphi}}{\sigma^2} \int_{\overline{\varphi}}^{+\infty} \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{\varphi^2}{2\sigma^2}} d\varphi - e^{-\frac{\overline{\varphi}^2}{2\sigma^2}} \frac{(\overline{\varphi}-1)}{\sigma^2} \int_{\overline{\varphi}}^{+\infty} \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(\varphi-1)^2}{2\sigma^2}} \quad \text{(A8)}$$

$$\left(\frac{\bar{\varphi}}{\sigma}\right)'_{\sigma} = \left(\frac{\frac{1}{2}+\sigma^2 \log[\frac{C_f(1-p)-C_p}{C_p}]}{\sigma}\right)'_{\sigma} = \left(\frac{\frac{1}{2}+\sigma^2 \log B}{\sigma}\right)'_{\sigma} = -\frac{1}{2\sigma^2}+\log B \qquad \text{(A9)}$$

$B=\dfrac{C_f(1-p)-C_p}{C_p}>0$ if there is no forbearance.

$$\left(\frac{\bar{\varphi}-1}{\sigma}\right)'_{\sigma} = \frac{1}{2\sigma^2}+\log B \qquad \text{(A10)}$$

Let $z=\bar{\varphi}/\sigma$, $y=(\bar{\varphi}-1)/\sigma$. Note that $z>y$.

$$N_2=\frac{1}{\sigma}[e^{-\frac{y^2}{2}} z\int_z^{+\infty}\frac{1}{\sqrt{2\pi}}e^{-\frac{x^2}{2^2}}dx - e^{-\frac{z^2}{2}} y\int_y^{+\infty}\frac{1}{\sqrt{2\pi}}e^{-\frac{x^2}{2^2}}dx]=$$

$$=\frac{1}{\sigma}e^{\frac{-z^2-y^2}{2}}[e^{\frac{z^2}{2}} z\int_z^{+\infty}\frac{1}{\sqrt{2\pi}}e^{-\frac{k^2}{2^2}}dk - e^{-\frac{y^2}{2}} y\int_y^{+\infty}\frac{1}{\sqrt{2\pi}}e^{-\frac{m^2}{2^2}}dm] \qquad \text{(A11)}$$

To prove that $N_2 \geq 0$ we need to prove that function *G(x)* is increasing *(z>y)*:

$$G(x)=e^{\frac{x^2}{2}} x\int_x^{+\infty}\frac{1}{\sqrt{2\pi}}e^{-\frac{k^2}{2^2}}dk \qquad \text{(A12)}$$

To prove that *G(x)* is increasing we need to prove that $\partial G/\partial x \geq 0$.

$$\frac{\partial G(x)}{\partial x}=\left(e^{\frac{x^2}{2}} x\int_x^{+\infty}\frac{1}{\sqrt{2\pi}}e^{-\frac{k^2}{2^2}}dk\right)'_x = -\frac{1}{\sqrt{2\pi}}e^{-\frac{x^2}{2}} xe^{\frac{x^2}{2}} + e^{\frac{x^2}{2}}\int_x^{+\infty}\frac{1}{\sqrt{2\pi}}e^{-\frac{k^2}{2^2}}dk + x^2e^{\frac{x^2}{2}}\int_x^{+\infty}\frac{1}{\sqrt{2\pi}}e^{-\frac{k^2}{2^2}}dk$$

(A13)

$\partial G/\partial x \geq 0$ if:

$$\int_x^{+\infty}\frac{1}{\sqrt{2\pi}}e^{-\frac{k^2}{2^2}}dk \geq \frac{1}{\sqrt{2\pi}}\frac{x}{e^{\frac{x^2}{2}}(x^2+1)} \qquad \text{(A14)}$$

or

$$\int_x^{+\infty}\frac{1}{\sqrt{2\pi}}e^{-\frac{k^2}{2^2}}dk(x^2e^{\frac{x^2}{2}}+e^{\frac{x^2}{2}}) \geq \frac{1}{\sqrt{2\pi}}x \qquad \text{(A15)}$$

Let us Q(x) to be equal to:

$$Q(x)=\int_{x}^{+\infty}\frac{1}{\sqrt{2\pi}}e^{-\frac{k^2}{2^2}}dk-\frac{1}{\sqrt{2\pi}}\frac{x}{e^{\frac{x^2}{2}}(x^2+1)}\geq 0 \qquad \text{(A16)}$$

Note that $Q(-\infty)=1$ and $Q(+\infty)=0$. It is easy to prove that Q(x) monotonously decreases.

We need to prove that:

$$\frac{\partial Q(x)}{\partial x}=-\frac{1}{\sqrt{2\pi}}e^{-\frac{x^2}{2}}-\frac{1}{\sqrt{2\pi}}\frac{e^{\frac{x^2}{2}}(x^2+1)-x(2xe^{\frac{x^2}{2}}+x(x^2+1)e^{\frac{x^2}{2}})}{\left(e^{\frac{x^2}{2}}(x^2+1)\right)^2}=\frac{-2}{\sqrt{2\pi}e^{\frac{x^2}{2}}(x^2+1)^2}<0$$

(A17)

Function Q(x) is monotonously decreasing on $-\infty<x<+\infty$, with $Q(-\infty)=1$ and $Q(+\infty)=0$. This means that $Q(x)\geq 0$ for any x. It follows immediately that $\partial G/\partial x\geq 0$ and $G(x)$ is increasing, $N_2\geq 0$. This means that $\partial \overline{L}/\partial\sigma\geq 0$.

APPENDIX 2.

DATA DESCRIPTION

The data set is constructed from financial statements banks provided to the Central bank of Russia in 1996-1999. The data include quarterly balance sheets for 1996-1999 and profit and losses statements for 1998-1999.

The data we have is the most comprehensive for this is the results of official reporting to a supervisor – CBR. In a panel regression run on the data average number of observations is 7.4 per group with absolute maximum of 8 observations per group. Therefore we think that unbalances in the data are not substantial. Furthermore bank is not automatically excluded from the sample after the license was withdrawn. Instead bank is still accountable to the CB even after the license was revoked and the bank is under receivership management. Therefore we think that data is missing rather randomly not resulting in selection bias.

Given the dynamic setting of the model, dynamic panel data econometric technique would be the optimal one to use. The implication of it is conditional on the data. The problem is that the data at our disposal is stock rather than flow. It naturally results from the system of balance sheet reporting. Therefore unsurprisingly there is great inertia in the data that one can feel from the preliminary work with the data. Furthermore our data set covers the total period of 4 years (from 1996 to 1999). In the middle of this period CB introduced changes in the accounting standards. This splits the data in two periods of 2 years, inside each of them data is fully compatible while it is not the case across the periods. Considering dynamic panel approach at the period of 2 years would crucially reduce the number of observations leaving us with something like 1.5 years. It is possible to capture any substantial dynamics of bank's portfolio over such a short period.

Problems arise if banks do not disclosure their true position. Banks may underestimate in official statements the amount of bad loans or losses, for example. However even if balance sheet does not reflect all the truth about a bank, there are always indicators of its financial position. For example, tricky deals usually increase other assets or other liabilities items of the balance sheet.

APPENDIX 3.

REGRESSION RESULTS

Table 3.1.
Logit estimates. 1 Jan, 1998.

Number of obs = 1201
LR chi2(7) = 294.24
Prob > chi2 = 0.000
Log likelihood = -275.051 Pseudo R2 = 0.3485

Probability of license withdrawal	Coeff.	z-value
Nn1 (capital adequacy)	0.75	2.43**
Nn2 (urgent liquidity)	0.43	1.16
Nn3 (current liquidity)	1.67	5.93***
Nn4 (mid-term liquidity)	-0.01	-0.01
Nn5 (overall liquidity)	1.33	3.80***
MOSCOW	-0.60	-1.97**
GOSBANK	-0.55	-0.93
Const	-3.31	-13.91***

Table 3.2.
Logit estimates. 1 Jan, 1999.

Logit estimates Number of obs = 1134
LR chi2(7) = 145.73
Prob > chi2 = 0.000
Log likelihood = -203.297 Pseudo R2 = 0.2639

Probability of license withdrawal	Coeff.	z-value
Nn1 (capital adequacy)	1.01	2.961***
Nn2 (urgent liquidity)	2.43	6.689***
Nn3 (current liquidity)	-0.33	-0.836
Nn4 (mid-term liquidity)	-0.14	-0.241
Nn5 (overall liquidity)	0.94	2.487**
MOSCOW	0.39	1.226
GOSBANK	0.30	0.68
Const	-4.06	-14.677***

Table 3.3.
Logit estimates. 1 Jan, 2000.

Number of obs = 1280
LR chi2(5) = 47.17
Prob > chi2 = 0.0000
Log likelihood = -75.27 Pseudo R2 = 0.2386

Probability of license withdrawal	Coeff.	z-value
Nn1 (capital adequacy)	-0.59	-0.461
Nn2 (urgent liquidity)	1.77	2.236**
Nn3 (current liquidity)	1.94	2.382**
MOSCOW	3.55	3.336***
GOSBANK	0.11	0.133
Const	-7.39	-6.925***

Table 3.4.

Credit risk exposure of Russian banks

	Cross-Section (1999)	Cross-Section (2000)	Random effect (1998-2000)
L(Loans to state)	-0.02	-0.01	0.02*
L(Loans to state-owned enterprises)	0.12***	0.08***	0.01*
L(Long-term loans to private enterprises)	0.19***	0.17***	0.08***
L(Short-term loans to private enterprises)	0.04	0.02	0.02***
L(State accounts)	0.11***	0.03	0.01
L(Transaction accounts)	-0.08**	-0.19***	-0.03***
Dummy for 100 largest banks	0.05	0.61**	0.14**
Dummy for the smallest banks	-0.76***	-0.63***	-0.28***
MOSCOW	-0.81***	-0.78***	-1.06***
GOSBANK	0.54***	0.61***	0.81***
Constant	2.43***	3.07***	2.59***
R2	25.8	21.3	20.1
R2 adj	25.3	20.7	NA
Number of observation	1328	1280	10288
Number of groups	NA	NA	7.6 (8 max)

All balance sheet indicators are taken as logarithms of balances' accounts per one worker.
L(.) indicates lag operator.

Table 3.5.
Open Currency Position as of July 1, 1998

Percentiles	All operating banks	Banks with large GKO portfolio
1%	-28.2	-25.9
5%	-10.2	-10.5
10%	-6.1	-4.6
25%	-1.0	-1.0
50%	0.2	0.6
75%	3.0	7.8
90%	11.1	20.0
95%	20.0	26.3
99%	34.4	54.1
Mean	**1.5**	**4.3**

Open Currency Position as percentage of Total assets.

Table 3.6.
Derivative risk exposure of Russian banks

Number of obs = 1484 R-squared 0.2496
F(11, 1472) 44.5 Adj R-squared 0.2439
Prob > F 0

	Coeff	T-statistics
L(Excess reserves)	-0.06	-2.46**
L(Capital)	-0.07	-5.18***
L(Deposits)	0.05	0.78
L(Transaction accounts)	-0.04	-2.00**
L(Government securities)	0.08	3.57***
MOSCOW	4.81	8.27***
GOSBANK	2.42	2.38**
Dummy for largest banks	25.62	6.61***
Dummy small -size banks	-10.02	-5.52***
Dummy smallest -size banks	-16.16	-11.03***
Constant	19.25	12.49***

All balance sheet variable are taken as shares of total assets.
L(.) indicates lag operator.

Table 3.7.
Unclear assets in the balances of Russian banks as shares of total assets (%).

Days before license Withdrawn	100 Largest banks	Smallest banks
>600	6.9	6.8
<600	14.7	12.6
<360	15.5	12.6
<100	16.8	13.5

Unclear assets include unidentified items in banks' balance sheet.

Fig. 3.1.

Anecdotal evidence of asset stripping

(Share of Other Assets as % of Total Assets on the vertical axe, days to license withdrawal on the horizontal axe)